

CLAIMS

What is claimed is:

- 1 1. A composition comprising:
2 at least one vinyl-terminated silicone oil;
3 at least one conductive filler; and
4 at least one hydrogen terminated silicone;
5 the composition being a curable and thermally conductive material.

- 1 2. The composition of claim 1 further comprising at least one silicone
2 crosslinker to form a gel thermal interface material with low modulus.

- 1 3. The composition of claim 2 wherein a mole fraction of equivalents of
2 silicone hydrogen bond (Si-H) provided by the hydrogen terminated silicone oil to a total
3 equivalents of Si-H provided by both the silicone crosslinker and the hydrogen
4 terminated silicon oil is at least 0.4.

- 1 4. The composition of claim 2 wherein the silicone crosslinker is a random
2 co-polymer comprising at least three silicone-hydrogen bonds (Si-H).

- 1 5. The composition of claim 1 wherein a molar ratio of Si-H equivalents to
2 Si-vinyl equivalents is in a range of approximately 2 to 0.6.

- 1 6. The composition of claim 5 wherein the ratio is approximately 1.

- 1 7. The composition of claim 1 wherein the conductive filler is one of
2 aluminum, silver, copper, aluminum nitride, aluminum oxide, zinc oxide, boron nitride,
3 aluminum nitride, silver coated copper, silver coated aluminum, and carbon fibers, and
4 alloys and mixture thereof.

- 1 8. The composition of claim 1 wherein the conductive filler has a particle
2 size of less than 300 microns.

1 9. The composition of claim 1 further comprising at least one catalyst for
2 curing reaction.

1 10. The composition of claim 9 further comprising at least one coupling agent
2 for the filler.

1 11. The composition of claim 9 further comprising at least one adhesion
2 promoter.

1 12. A method comprising:
2 combining at least one vinyl-terminated silicone oil, at least one conductive filler,
3 and at least one hydrogen terminated silicone oil to form a curable thermal interface
4 material (TIM).

1 13. The method of claim 12 further comprising combining a silicone
2 crosslinker to form a gel thermal interface material with low modulus.

1 14. The method of claim 13 wherein a mole fraction of equivalents of silicone
2 hydrogen bond (Si-H) provided by the hydrogen terminated silicone oil to a total
3 equivalents of Si-H provided by both the silicone crosslinker and the hydrogen
4 terminated silicon oil is at least 0.4.

1 15. The method of claim 13 wherein the silicone crosslinker is a random co-
2 polymer comprising at least three silicone-hydrogen bonds (Si-H).

1 16. The method of claim 12 wherein a molar ratio of equivalents silicone-
2 hydrogen bonds (Si-H) to equivalents of silicon-vinyl bonds (Si-vinyl) is in a range of
3 approximately 2 to 0.6.

1 17. The method of claim 12 wherein the ratio is approximately 1.0.

1 18. The method of claim 12 wherein the conductive filler is one of aluminum,
2 silver, copper, aluminum nitride, aluminum oxide, zinc oxide, boron nitride, aluminum
3 nitride, silver coated copper, silver coated aluminum, carbon fibers, alloys and mixtures
4 thereof.

1 19. The method of claim 12 further comprising combining at least one catalyst
2 for curing reaction.

1 20. The method of claim 19 further comprising combining at least one
2 coupling agent for the filler.

1 21. The method of claim 19 further comprising combining at least one
2 adhesion promoter.

1 22. A processor assembly comprising:
2 a semiconductor device;
3 a heat spreader coupled to the semiconductor device;
4 a first curable thermal material between the semiconductor device and the heat
5 spreader to provide thermal resistance, the first curable thermal material comprising:
6 at least one vinyl-terminated silicone oil;
7 at least one conductive filler; and
8 at least one hydrogen terminated silicone oil;
9 a thermal element coupled to the heat spreader; and
10 a second curable thermal material between the heat spreader and the thermal
11 element, the second curable thermal material comprising:
12 at least one vinyl-terminated silicone oil;
13 at least one conductive filler; and
14 at least one hydrogen terminated silicone oil.

1 23. The processor assembly of claim 22 further comprising:
2 a substrate coupled to the semiconductor device; and
3 an interposer coupled to the substrate.

1 24. The processor assembly of claim 23 further comprising:
2 a first plurality of solder bumps coupling the substrate to the semiconductor
3 device; and
4 a second plurality of solder bumps coupling the semiconductor device to the
5 substrate.

1 25. The processor assembly of claim 23 further comprising:
2 a plurality of pins extending outwardly from the interposer.

1 26. The processor assembly of claim 22 wherein the first and second curable
2 material further comprises at least one silicone crosslinker to form a gel thermal interface
3 with low modulus.

1 27. The processor assembly of claim 26 wherein a mole fraction of
2 equivalents of silicone hydrogen bond (Si-H) provided by the hydrogen terminated
3 silicone oil to a total equivalents of Si-H provided by both the silicone crosslinker and the
4 hydrogen terminated silicone oil is at least 0.4.

1 28. The processor assembly of claim 26 wherein the silicone crosslinker is a
2 random co-polymer comprising at least three silicone-hydrogen bonds (Si-H).

1 29. The processor assembly of claim 22 wherein a molar ratio of Si-H
2 equivalents to Si-vinyl equivalents is in a range of approximately 2 to 0.6.

1 30. The processor assembly of claim 22 further comprising:
2 a substrate coupled to the semiconductor device; and
3 a plurality of pins extending outwardly from the substrate.